Building connections between kangaroos, commerce and conservation in the rangelands

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ABSTRACT

The role of landholders in kangaroo harvesting is an issue that has been revisited often over time as circumstances continue to change within the kangaroo industry, within rural communities and within national and international conservation frameworks. It is again time to assess the state of play. The kangaroo industry has, after more than 30 years of operation, a legitimate claim to being sustainable. But where does it stand in relation to current international thinking on sustainable use and in relation to the broader conservation goals for Australia's rangeland environments?

This paper presents strategies for linking the kangaroo harvest with conservation in the sheep rangelands through models that can provide economic returns and a greater management role for landholders in the kangaroo industry. According to the principles of conservation through sustainable use (CSU), when local people receive direct economic returns from the sustainable use of wildlife, they can gain incentives to undertake species and habitat conservation. This is not happening with kangaroo harvesting at present and if it is to be achieved we need improved knowledge of kangaroo grazing dynamics, increased valuing of kangaroo products, pathways for landholders to engage with the industry and a clear will on the part of government agencies responsible for managing the harvest to move beyond the frameworks that have traditionally guided kangaroo management policy in Australia.

Key words: Kangaroos; sustainable use; conservation; harvesting; wildlife management; rangelands; total grazing pressure; adaptive management

Introduction

Now is an excellent time for revisiting the place of kangaroos in Australia's rural industries. After 30 years of harvesting under a quota system it is clear that the industry is sustainable and will not lead to the extinction of the four commercial species. The rhetoric of pest control is making way for the rhetoric of sustainable use. Occasional episodes of opposition are having less impact as the community develops greater acceptance of the harvest and its increasingly professional and scientific basis.

Although it is difficult to obtain reliable figures on kangaroo meat consumption, its position in the domestic marketplace is undergoing significant change. It is now available in major Australian supermarket chains in a diversity of products and in much larger volumes than just a few years ago. With supply controlled by harvest quotas and impacted on by drought in recent years, it has been demonstrated that increased demand can lead to an increase in the prices offered by processors.

This is occurring in the context of a declining wool industry with falling sheep numbers and wool returns, declining terms of trade and increased reliance on off-farm incomes. This is exacerbated by periods of extreme drought and the increasing realisation that traditional industries will not provide the economic driver for better natural resource management in many areas. Landholders are moving into meat sheep and goats, and there are increasing calls for diversification into tourism and other enterprises. Incentives are being sought for conservation-orientated management through market-based instruments and programs such 'enterprise based conservation'. Catchment targets are being set for larger areas of native vegetation and larger areas 'managed for conservation'.

Kangaroos clearly have a role in this emerging situation. They are abundant, superbly adapted animals that compete less with domestic stock than is conventionally thought. They range across the landscape utilising herbage where it is available, causing localised increases in total grazing pressure. While their numbers fluctuate, they restock themselves after droughts. They provide high quality products with growing demand and an increasing price without global competition.

Despite this, landholders currently have negligible participation in the kangaroo industry and receive little or no economic return from it. They have been willing to cooperate with the harvest regulation system and pass on their potential ownership of the resource to the industry without any expectation of an economic return. Can they carve out a place for themselves in the industry? Do they want to? What are the potential benefits for them and for conservation if they do? And if the potential is there, why aren't they already doing it? These questions are central to this paper.

So what will it take to get landholders into the industry? While it would be true to say that there is a degree of cultural resistance and significant scepticism towards it, there are landholders who have tried in the past and are willing to try in the future. We believe there are four critical components to facilitating the process:

1) More accurate knowledge obtained and communicated to stakeholders on kangaroos' contribution to total grazing pressure and the extent to which they compete with sheep;
2) Increased value of kangaroo products as compared to other products (i.e. wool in particular);
3) More flexible State kangaroo management plans with clearly stated aims and provision for adaptive management trials that encourage rather than inhibit landholder involvement in and returns from harvesting;
4) The development of enterprise models through which landholders can claim a legitimate role in the industry and through which they can gain some economic benefit.

Significant commercial involvement of landholders in the kangaroo industry is unlikely to occur unless there is an increase in end prices paid for kangaroo products. However, increased prices and markets for kangaroo products alone will not provide conservation incentives if landholders are not able or prepared to get involved in the industry. Furthermore, any decision by landholders to become producers of kangaroo products rather than (or as well as) producers of other commodities such as wool will be a business decision and, as such, the potential income from kangaroos needs to be measured accurately alongside the costs of managing kangaroo production on a property. Ideally, these critical components should all be addressed together to achieve conservation benefits through commercial kangaroo harvesting.

In the following section we describe in more detail the trends and issues summarised above that lead us to the conclusion that now is a good time to push for changes in the industry and the way it is regulated. In the subsequent two sections we review the current state of knowledge of kangaroos in rangeland environments and the state of the kangaroo industry, looking at the potential for increasing market demand and thus the value of kangaroo meat. We then explore the current regulatory environment (with greater emphasis on NSW) and outline changes that could lead to a more flexible system. Finally, we describe models for landholder involvement, including a staged model that the FATE Program is developing in collaboration with the Barrier Area Rangecare Group north of Broken Hill.

Is it time for change?

The current situation

The commercial kangaroo harvesting industry in Australia means different things to different stakeholders. To many landholders, it is simply a cost-effective means of reducing their stock's competition for pasture and water; to some wildlife protection groups it is a threat to the very existence of the kangaroo species it harvests; to some 4000 people employed in the industry (Kelly 2004, 2005a) it is a livelihood; and to advocates of the concept of conservation through sustainable use (CSU), it is a potential way to create incentives to conserve native habitat through commercial returns to landholders.

This paper focuses on the latter point – the potential for creating incentives for conservation through the commercial returns generated by the sustainable harvesting of kangaroos. This idea is not new and indeed has been debated vigorously, particularly following Grigg's (1987) call for commercial use of kangaroos to form "a better economic base for our rangelands". As the viability of the concept is so highly dependent on complex economic, social, ecological and political factors that vary over time, it is only natural that the kangaroo debate be regularly revisited.

At this point in time, a number of factors require integration into the ongoing discourse. The 2004 report into "Kangaroo Management in the Murray-Darling Basin" (Hacker *et al.* 2004) presented a number of recommendations for managing kangaroos as a component of total grazing pressure, while the 2005-2010 Kangaroo Industry Strategic Plan (Kelly 2005a) outlines the industry's vision and priorities for the next five years. There are also ongoing ramifications from the Senate Committee Report into Commercial Utilisation of Australian Native Wildlife (Rural and Regional Affairs and Transport References Committee 1998), including the exploration of sustainable wildlife enterprises by the Rural Industries Research and Development Corporation (RIRDC) in response to the Senate Committee's recommendations.

Furthermore, in the international realm, the Convention on Biological Diversity and IUCN (World Conservation Union) have endorsed the Addis Ababa Principles and Guidelines on Sustainable Use of Biodiversity (Secretariat of the Convention on Biological Diversity 2004), which emphasise the potential for sustainable use activities to lead to sustainable development and create incentives for conservation.

It is clear from the 30-plus years of commercial kangaroo harvesting in Australia, and the extensive research that has been conducted over that time, that this is a use of a renewable natural resource that is demonstrably sustainable in terms of population numbers, species distributions and genetic diversity. The sustainability of the harvest has been demonstrated repeatedly in published research (e.g. Pople and Grigg 1999) and as part of management plan assessment processes, including reviews by the Administrative Appeals Tribunal in 2003 and 2004. The recent situation analysis undertaken as part of the review of the NSW Kangaroo Management Program (Olsen and Low 2006) concludes that "there is little doubt that current rates of harvest are sustainable" and that "any genetic impact of harvesting is minimal" (p7).

Briefly, populations of the four large species commercially harvested across New South Wales, Queensland, South Australia and Western Australian – namely the Eastern Grey Kangaroo *Macropus giganteus*, Western Grey Kangaroo *Macropus fuliginosus*, Red Kangaroo *Macropus rufus* and Wallaroo/Euro *Macropus robustus* - have been shown to remain viable at the harvest levels of 8-10% that are routinely achieved. Modelling also shows that larger harvests would be sustainable, especially given the significant level of male bias in the harvest (Grigg 2002). As Hacker *et al.* (2004) asserted, the industry is also capable of a significant degree of self-regulation, as "the commercial industry is not viable at kangaroo densities that might threaten the conservation of the species" (p54).

Research into the genetics of harvested populations (Tenhumberg *et al.* 2004) has shown that a moderate level of dispersal from unharvested refuges into harvested areas is sufficient to prevent long-term genetic changes in kangaroo populations that could arise from size-selective harvesting (i.e. targeting the largest males). Dispersal from such refuges is a feature of kangaroo harvesting in each State, due to both land tenure (i.e. National Parks where harvesting is not permitted) and the existence of areas that are uneconomic to harvest (Hacker *et al.* 2004).

However, while populations of large kangaroos have been shown to be secure under current commercial harvesting regimes, it is less certain that kangaroo harvesting, as it occurs at present, is really a good example of the conservation benefits that can be achieved through the sustainable use of wildlife. The key concept underpinning conservation through sustainable use (CSU) is that by placing a commercial value on a species, we can enhance the conservation of that species and its habitat by creating incentives to use the resource sustainably and protect the ecosystems that support it.

At present it cannot be said that commercial kangaroo harvesting has really led to any deliberate actions by landholders to conserve kangaroos or their habitat. Indeed, the success of the large kangaroo species since European settlement is incidental rather than deliberate, as the conditions that pastoralists have created to maximise sheep production across the Australian rangelands (i.e. creation of artificial watering points, conversion of woodland to grassland and exclusion of predatory dingoes) have also inadvertently favoured the large kangaroo species (Grigg and Pople 2001). Where this has occurred, however, the impact on other aspects of biodiversity has been negative. This is especially true of small mammals such as bilbies, bettongs, bandicoots and potoroos. The loss of these species from the rangelands has removed key ecosystem engineers, with consequent impacts on soil biota, water infiltration, plant diversity and fire regimes (Martin 2003).

It is likely that large kangaroos have prospered in spite of the attitudes of landholders towards them, rather than because of their attitudes. Judging by Grigg's (2002) statement that "most landholders still regard kangaroos mainly as pests" (p53), if it had been technically and economically feasible – and legally permissible – for pastoralists to eradicate kangaroos from their properties many may have done so by now, in the same way that other perceived pests, such as the Thylacine and Dingo, have been eradicated or severely reduced in numbers. We recognise that the term "pest" carries a lot of connotations and does not necessarily represent the way that all landholders view kangaroos. Undoubtedly many landholders value having kangaroos in the landscape and eradication is not their desire, but what is clear is that perceptions of kangaroos as too numerous and a cost to production are far more prominent amongst landholders than perceptions of kangaroos as an economically desirable presence on their land.

How could commercial kangaroo harvesting lead to conservation outcomes?

In contrast to the current situation, a conservation through sustainable use (CSU) approach aims to ensure that species will be conserved because they are valued, not simply because they are difficult to eradicate. The focus of CSU is on ensuring that the use of wildlife is undertaken in a way that is ecologically, economically and socially sustainable and examples of CSU vary with differing ecological, economic and social factors. Some of the best-known examples of CSU include the conservation of southern African wildlife through the creation of numerous private reserves for wildlife tourism and hunting, the contribution of harvesting to the recovery of Saltwater Crocodile populations in the Northern Territory (Webb 2002), and the role of deer stalking estates in preventing Red Deer in Scotland from going the way of other Scottish forest-dwelling mammals and becoming extinct due to forest clearing (Inskipp 2000).

Webb (2002) stated that "the central aim of most CSU programmes is to create incentives for habitat conservation" (p14). A focus on habitats is vital as CSU is not just about conserving the utilised species, but the habitat that supports it and a myriad of other species. Citing the contribution that the controlled harvest of Saltwater Crocodiles and their eggs has made in encouraging landholder protection of habitat for Saltwater Crocodiles in the Northern Territory, Webb (2002) stated that "relatively small economic returns can change the perception of a wildlife species or a patch of habitat from a liability to an asset" (p14).

There are some parallels with this asset vs. liability issue in the case of kangaroos. A preference amongst Eastern Grey Kangaroos for native vegetation mosaics that feature interspersed woodlands, forests and grasslands has been reported in studies of disturbed semi-arid woodlands in Queensland (McAlpine 1999) as well as on farmland in the Australian Capital Territory (Viggers and Hearn 2005). This preference can often lead to reserves or remnant woodlands being perceived to be a liability for the role they play in sheltering kangaroos that then move onto adjacent grazing or cropping land (Viggers and Hearn 2005). This, in turn, can create a disincentive to undertake revegetation activities and even lead to illegal clearance of sheltering vegetation (Grigg and Pople 2001). A commercial return for landholders from kangaroos that utilise these vegetation mosaics could change them from a liability to an asset and provide an incentive for conservation and revegetation activities across the heavily cleared landscapes that coincide with much of the Eastern Grey's range.

However, in the semi-arid sheep rangelands, which cover about 40% of the continent (Grigg 2002) and where the bulk of the commercial kangaroo harvest takes place, the key issue is total grazing pressure (TGP) rather than revegetation or protection of remnants. This represents a significant deviation from other CSU models such as those shown for crocodiles (Webb 2002), in that kangaroo habitat is not separate from livestock habitat but instead is shared with sheep across much of Australia's rangelands and actions undertaken to benefit sheep (eg increase in watering points, control of dingoes) have also benefited kangaroos. While kangaroos themselves may be seen as a liability in the rangelands, their habitat is clearly an asset and is valued for its productivity. As such, it is not so much a matter of protecting habitat specifically for kangaroos in the rangelands as it is a matter of better managing the land that supports both livestock and kangaroos.

Gordon Grigg has long advocated the concept of “sheep replacement therapy for rangelands” (Grigg 1987, 1989, 2002) and it may indeed be possible that in some areas, under the right economic conditions, a total shift from sheep to kangaroos could take place. However, this does not mean that total replacement of sheep with kangaroos is the only way for CSU benefits to be achieved, nor does it necessarily mean the goal of any CSU initiative should be to increase kangaroo numbers. Croft (2000) emphasises the importance of considering potential synergies between herbivores and points to experiences in South Africa where springbok and merino sheep are grazed together for economic sustainability. Similarly, strategic cattle grazing has been shown to enhance elk and deer habitat in the western USA (Short and Knight 2003).

The benefits that could result from exploring these synergies in relation to kangaroos and sheep could include;

- reducing disincentives to revegetate or destock areas for conservation that may arise because these activities can lead to localised kangaroo population increases;
- increasing incentives to create more kangaroo-friendly and biodiversity-friendly vegetation mosaics;
- supplementing and diversifying pastoral incomes to resist economic pressures to over-stock; and
- delivering greater flexibility in managing total grazing pressure by reducing the dependence on the existing industry which will only operate in locations where, and at times when, it is profitable to do so.

If landholders come to value kangaroos in the same way as domestic stock and are therefore prepared to invest a greater amount of time and money into kangaroo management, they may be able to adapt some of the best practice stock management approaches to managing kangaroos, such as;

- reducing numbers heavily going into drought;
- maximising breeding potential relative to grazing pressure by harvesting with a strong male and/or juvenile bias; and
- rotating or adjusting grazing pressure through restricting access to watering points.

This may not be a typical approach to CSU but it may well play an important role in facilitating some of the desired shifts towards managing rangelands for improved conservation outcomes. A testable hypothesis of any CSU approach to kangaroo management in the rangelands would be whether commercially valuing kangaroos could lead to the implementation of these sorts of strategies and whether they could improve management of total grazing pressure and improve landscape function and biodiversity in the rangelands.

Links with regional NRM targets and management actions

The goal of creating incentives for landholders to undertake conservation work is a particularly important one in Australia at the present time. The move to regionalised natural resource management (NRM) under Commonwealth and State government agreements creates requirements for the setting of State-wide and regional NRM targets and for the creation of regional NRM bodies. In the case of NSW for example (Natural Resources Commission 2004), some of the draft State-wide NRM targets for 2015 include:

- a net increase in native vegetation cover, diversity and connectivity;
- a net increase in riparian vegetation extent;
- reduced risks to conservation status of species and communities; and
- deep-rooted perennial vegetation coverage of *all* critical recharge zones.

There is a need for substantial incentives to deliver these targets on a landscape scale and the potential for some of these incentives, such as trading schemes and auctions, has been explored through a National Market-Based Instruments Pilot Program (Anon 2002). Landholders can incur significant financial costs through the revegetation of land and other management actions, as well as associated lost income from restrictions on clearing, reductions in stocking rate or reductions in areas under cultivation. Conservation incentives can provide a counter to these costs and CSU is one potential way of generating such incentives to protect or restore habitat. In some areas, returns from kangaroo harvesting could encourage the conversion of cleared land to the types of patchy woodland mosaics that have been shown to benefit some kangaroo populations.

State-wide targets are not equally applicable in all regions and in Australia’s arid and semi-arid sheep rangelands, such as the Western and Lower Murray Darling catchments in western NSW, regional NRM targets are less likely to focus on the extent of native vegetation and more likely to focus on quality of cover, biodiversity and landscape function. For example, the draft Catchment Plan for the Western Catchment Management Authority (2005) in northwest NSW, identifies the following land and biodiversity targets which have particular relevance to kangaroo management:

- Quality and quantity of vegetation managed to maintain and/or improve designated cover capable of preventing soil erosion (i.e.: designated cover greater than or equal to 40%).
- Ecological communities of high conservation value are adequately protected.
- In each of the other ecological communities, 12% of the area will be managed for conservation within 10 years of Catchment Plan approval and 25% within 25 years.

These catchment targets have a strong focus on private land and will be delivered through programs aimed at promoting sustainable agriculture, improving pest management, rehabilitating native pasture vegetation communities and negotiating agreements with landholders to manage lands for conservation (Western Catchment Management Authority 2005). A key element in delivering these outcomes on private pastoral land will be improved management of total grazing pressure (TGP), in which kangaroo harvesting has a key role to play. Reductions in domestic stock across the rangelands are likely to reduce the economic viability of pastoral enterprises unless alternative sources of income are found. Incentives that could be generated by a kangaroo CSU initiative are particularly important for rangelands where traditional production activities are becoming less economically viable.

Of course, amidst this discussion it is important to remember that CSU is only one conservation tool that is available, and is not designed to replace all other approaches or leave conservation entirely up to market forces. There is also a need to consider the possible perverse incentives and other pitfalls of sustainable use approaches. Using an earlier example, while Red Deer populations may have been enhanced due to the value placed on them in Scotland, an overpopulation now threatens rather than protects habitat in some locations (Inskipp 2000). Similarly, a perverse incentive to clear land could arise in relation to red kangaroos, which have been shown in Queensland to prefer areas subject to recent large-scale clearing over woodlands (McAlpine *et al.* 1999). As such, measures such as land-clearing and threatened species regulations will always be vitally important to back up any incentives from CSU with appropriate regulatory measures.

How can kangaroo harvesting be managed to achieve conservation through sustainable use?

Useful guidance in this area comes from the Addis Ababa Principles and Guidelines on Sustainable Use (Secretariat of the Convention on Biological Diversity 2004), which have been endorsed by the Parties to the Convention on Biological Diversity (CBD) and the IUCN. This document states that “encouraging sustainable use can provide incentives to maintain habitats and ecosystems, the species within them, and the genetic variability of the species” (p7) and sets out the principles that need to be followed when managing sustainable use activities. These include complementary regulations, access rights, involvement of local people, removal of perverse incentives, adaptive management, communication and education, and management at appropriate scales (generally devolved as locally as possible).

The Addis Ababa Principles (Secretariat of the Convention on Biological Diversity 2004) highlight the need for the economic benefits of resource use to flow to local people who have legal rights of ownership or access and powers of management over these resources if incentives for conservation are to be created. Similarly, Webb (2002) emphasises the importance of involving local people as active partners if CSU is to be realised and the Northern Territory Strategy for Conservation through the Sustainable Use of Wildlife has amongst its guiding principles that “landowners must be key beneficiaries from any use of wildlife that takes place on their lands” (Parks and Wildlife Commission of the Northern Territory 1997, p3).

In our view, the fundamental aspect that must be remedied before kangaroo harvesting can truly become an example of CSU is the involvement of landholders and the flow of significant economic returns to them, as they have primary stewardship over kangaroo habitat. While the language of kangaroo harvesting amongst government agencies, scientists and the industry may have changed from pest control to sustainable use in recent years, attitudes are yet to undergo the same transformation for those who are most impacted by kangaroos and in the best position to manage them – landholders. As Croft (2004) comments on the rebadging of kangaroo management as sustainable use: “a change in the purpose for the commercial killing of kangaroos is yet to see a significant change in the value of the end products and the valuing of their producer” (p101).

Grigg (2002) and Dawson and Munn (in press) argue that perceptions of kangaroos as pests or problem animals are often overstated, as the extent of their contribution to total grazing pressure (TGP) and their levels of competition with sheep may have traditionally been over-estimated. However, for as long as a landholder is not making any commercial gain from kangaroos, any cost incurred by the presence of kangaroos on the landholder’s production of valued products such as wool, however small, is bound to tip their view of kangaroos towards the “pest” rather that “resource” side of the equation.

Kangaroos in the rangelands

Australia’s sheep rangelands provide the most likely site for investigating landholder-based kangaroo enterprises in the near future, due to the high densities of kangaroos, large landholdings, established kangaroo industry presence and decreasing viability of traditional wool production over time. This is an area where landholders are increasingly being squeezed by declining returns and increasing costs, sheep numbers are continuing to fall at a time when higher production levels are needed to stay profitable and recurring government investment is required in the form of drought relief in order to keep many enterprises afloat.

In many parts of the rangelands, overgrazing (by stock, feral and native herbivores) has contributed to loss of vegetation cover, soil erosion and potentially permanent changes in landscape function (Donohue *et al.* 2005). Many of these impacts have their origins in overgrazing and severe drought in the late 19th century (Australian State of the Environment Committee 2001) and demonstrate the economic and ecological challenges of maintaining production and managing environments that feature highly variable climates and substantial alteration due to 150 or more years of grazing (Eldridge and Koen 2003).

There has been a significant decline in the last decade in the number of farms involved in extensive sheep production and there is a very high reliance on off-farm income amongst Australian farm businesses with an annual EVAO (estimated value of agricultural output) of less than $100 000 (Synapse Research & Consulting Pty Ltd and Bob Hudson Consulting Pty Ltd 2005). While this situation provides a potential threat to rangeland health through pressure to carry more sheep to break even, it also provides an opportunity through the fact that, as sheep grazing becomes more marginal, alternative sources of income such as kangaroos can become more attractive.

However, before landholders can effectively enter the kangaroo industry, they will need accurate information on the potential costs and returns from a kangaroo enterprise such as modelling of income and expenditure (Stayner 2005) and on the effect of kangaroo density on wool production, land condition and biodiversity (Hacker *et al.* 2004). If kangaroos can gain an economic value for landholders, even if it is only a small value, it will then become vitally important to accurately quantify the relative use of the land's pasture and water resources in order to produce a kangaroo as opposed to being used for some other form of production, such as wool.

Much has been written about the flaws of comparing sheep and kangaroos under the traditional model of total grazing pressure (TGP) which measures TGP in terms of dry sheep equivalent (DSE). DSE is based on the forage consumed by a 45kg Merino wether (or ewe without a lamb) and kangaroos are often assumed (eg by Departments of Agriculture) to have a value of 0.7 DSE based on a comparison of the resting metabolic rates of the two animals (i.e. an average kangaroo would consume 70% of the amount of a standard 45kg sheep).

Grigg (2002) observed that this TGP model is flawed in two main ways. Firstly, he noted that an average kangaroo generally weighs a lot less than 45kg, especially in a harvested population. Secondly, if field metabolic rates (FMR) are used instead of resting rates (i.e. metabolic rate across resting, foraging and all other activities), kangaroos may require even less feed again, possibly making the true DSE as low as 0.15-0.2. Olsen and Low (2006) favoured a DSE of 0.48 based on recent empirical data from Dawson and Munn (in press).

Overall, it appears that kangaroo DSE is much less than traditionally thought and competition is only ever really significant at times when pasture resources are scarce. In their recent review, Olsen and Low (2006) concluded that "kangaroos and livestock do not compete strongly for food (at least in the rangelands), that resource availability drives the grazing system, and that mixed species grazing regimes are more productive and ecologically sound" (p65).

An integrated TGP management approach could provide an avenue for improving rangeland health while ensuring continued pastoral income by focusing on strategic use of domestic stock (e.g. rotational or tactical grazing, destocking during drought) and strategic harvesting of kangaroos (e.g. heavier harvesting entering drought, male-bias to optimise harvest, maintaining breeding population through drought, predicting kangaroo movements as part of a rotational harvesting strategy). Kangaroos could offer landholders potential offsets to loss of income in times of drought, particularly as harvesting going into drought generally represents 'compensatory mortality' (i.e. harvesting animals that are likely to die anyway).

Despite these possibilities, Olsen and Low (2006) noted that at present there is "no integration of commercial harvesting with grazing practices" (p54). Landholders are ill-equipped to undertake such integration of sheep and kangaroo management in the absence of the financial incentives required to manage kangaroos for their production value and clear guidance on synergistic grazing strategies.

If landholders start to place a significant resource value on kangaroo production, there could be an incentive to invest more time and money in integrating kangaroos into TGP management, but better knowledge must be made available to landholders on what an optimal mixed grazing system might look like. The undertaking of further research into this area, particularly under an adaptive management approach, and the dissemination of the results of this research to landholders is a vital component of changing kangaroo harvesting into a true example of conservation through sustainable use.

Increased commercial value of kangaroos

The Kangaroo Industry Strategic Plan 2005-2010 (Kelly 2005a) outlines the present state of the industry and the strategies for increasing demand and prices for kangaroo products. Currently, 60-70% of kangaroos taken are processed for pet food due to lack of sufficient demand for meat for human consumption. In addition to this, skin-only shooting, while declining as a proportion of the overall harvest, continues in Queensland due to the prices paid for whole carcasses being outweighed by the costs of transport and storage, particularly in remote areas. In most years, supply outweighs demand and annual harvest quotas are not reached, however, drought in recent times across much of Australia has resulted in population declines and a serious undersupply issue for the kangaroo industry (Kelly 2005a).

A number of avenues are currently being pursued to increase the returns from each kangaroo carcass. These include promotion of the meat's health qualities and environmental credentials through videos, newsletters and websites (Kelly 2003, 2004) and the introduction of kangaroo meat into the curricula of chef courses (Kelly 2005b). The kangaroo industry also continues to develop new products and recipes and target new markets in Australia and overseas. Acceptance of kangaroo by the domestic smallgoods sector could also contribute significantly to demand.

With regard to kangaroo skins, while the strategic plan identifies a need for improved quality control, Grigg (2002) argued that there is little scope to increase prices, as manufacturers can turn to cheaper leathers such as calf when kangaroo prices rise, as they currently do when shortages occur.

The Kangaroo Industry Strategic Plan sets a target for 2015 of 80% of kangaroo meat being sold within Australia at prices 10% higher (in real terms) than present (Kelly 2005a, p8). In Australia, a small but relatively stable market exists for human consumption of kangaroo meat despite relatively little promotion, while the overseas market is larger but less stable (Kelly 2005a). In recent times kangaroo products have become more accessible in Australian supermarkets, particularly with a major supermarket chain resuming stocking kangaroo after a hiatus brought about due to protest actions by animal liberationists in the 1980s (Kelly 2004). However, little is known about the market sectors that currently consume kangaroo in Australia and what marketing interventions would be most effective in boosting consumption.

Aside from the obstacles presented by trying to encourage Australians to consume a cute, furry national icon and the animal welfare claims disseminated by animal liberationists, the low consumption of kangaroo meat amongst Australians has been attributed to inherited English ideas, perceptions of kangaroo as a low-quality meat, poor butchering and unfamiliarity with cooking a very lean meat that becomes tough when overcooked (Hercock 2004, Hercock and Tonts 2004). Hercock (2004) also hypothesised that the relatively strong acceptance of kangaroo meat in continental Europe (particularly in France, Belgium and Germany) may be due to an established culture of game meat consumption which is less present in Australia. Supporting this is the assertion by Wynn *et al.* (2004) that Australians have a bias against darker coloured meats that is not evident amongst German consumers.

Grigg (2002) saw the European and US markets, where game meat has historically been appreciated, as the logical way to expand the market for kangaroo meat. Potential market growth may exist with reduced consumer confidence in farmed and lot-fed meats following outbreaks of 'mad-cow disease' and foot-and-mouth disease around the world. There is also an ongoing trend towards free-range, chemical-free and organic meats in developed countries (Hercock 2004). Another potential consideration is the growing trend in consumer-behaviour towards the *centrally-conscious consumer*, who is more likely to respond to the health attributes of kangaroo products rather than any social or environmental management benefits (Mulcahy 2004).

A sensible way forward on this issue is through detailed studies of consumer choice behaviour in kangaroo consumption to inform marketing approaches tailored towards specific market sectors. A recent study funded by the Rural Industries Research and Development Corporation (RIRDC) looked at the influence of factors such as species, age and handling on taste, tenderness and variability of meat quality (Wynn *et al.* 2004). Implementation of these findings by processors and harvesters could lead to increased human consumption of kangaroo meat through improved product consistency and consumer satisfaction.

The FATE (Future of Australia's Threatened Ecosystems) Program at the University of New South Wales, in conjunction with the School of Marketing, University of Technology, Sydney (UTS), is conducting research funded by RIRDC looking at the attributes that influence consumption of kangaroo meat through discrete choice experiments. Such attributes would include price, health benefits and environmental credentials. This proposal has a key focus on the use of kangaroo meat in smallgoods manufacture within Australian, as uptake from the smallgoods industry could improve carcass values overall and lead to returns flowing to landholders.

For the existing kangaroo industry, greater landholder involvement is not currently a priority under the 2005-2010 Strategic Plan (Kelly 2005a). It is the position of the industry generally that landholders can get involved by becoming harvesters (shooters), and the idea of landholders deriving returns as the producers and managers of kangaroos understandably represents a threat to existing industry players through potentially having to share their revenue with landholders. However, in the longer-term, landholder involvement could actually be vital for the industry to grow. While increased landholder involvement is not an objective of the Industry Strategic Plan, improving the supply chain is (Kelly 2005a, p19) and it could be argued that you can't really have one without the other. Direct landholder-processor engagement could improve quality control and continuity of supply through improved consistency in the age, gender and species of kangaroos harvested and the timing of the harvest.

If conservation benefits can be shown to result from the sustainable use of kangaroos, it could open new markets based on the environmental attributes of kangaroo products and the wildlife stewardship of landholders. Landholder involvement could also potentially increase the size of the harvest and thus supply for the industry, through measures such as creating native vegetation mosaics that support kangaroos, strategic harvesting to maximise compensatory mortality and strategically maintaining breeding populations of kangaroos to repopulate following droughts. Changing perceptions of kangaroos from a pest to a resource at the landholder level may also translate to a greater valuing of kangaroo meat by consumers, as the continuing pest association in the consumer consciousness is likely to reinforce perceptions of low quality and low value products.

Change of focus in Kangaroo Management Programs

If incentives for conservation through use are to be generated through commercial kangaroo harvesting then government agencies responsible for managing the harvest need to be more pro-active in facilitating a legitimate role for landholders in the harvesting and post-harvest handling of kangaroos. Conservation agencies have traditionally been most involved in gathering data on kangaroo populations, setting harvest quotas and regulating where, how and by whom the harvest is carried out. This role has emerged as a result of balancing landholder desires for pest control with the kangaroo industry's need for continued supply and the need to demonstrate that the harvested species are adequately protected. In recent years, the terminology of State management plans has switched to sustainable use of a natural resource, with pest control not overtly mentioned, but there is little recognition within the plans of the social and economic factors that are tied to this resource use, or the broader ecosystem context of kangaroo harvesting and the potential for sustainable use to provide incentives that could contribute to regional NRM objectives.

In our opinion, State management plans for the commercial harvest of kangaroos (Queensland Parks and Wildlife Service 2002; New South Wales National Parks and Wildlife Service 2001; Department for Environment and Heritage 2002; Department of Conservation and Land Management 2002a&b) are achieving their goals in relation to protecting and sustaining viable kangaroo populations, but they are also contributing to a system that sidelines landholders, is inflexible for shooters who are tempted to 'work around' the system and doesn't deliver, in the eyes of landholders, adequate control of kangaroo numbers when they need it most. What is needed is a more flexible approach that removes barriers to landholder involvement while maintaining adequate control over the harvest.

Hercock (2004) proposed a model for the management of the kangaroo industry based on a management board with responsibility for the promotion and development of the kangaroo industry as well as its regulation. Different agencies, with responsibilities for conservation, market development and research could all sit on the board and govern the industry overall. Depending on how it was set up, such a model could encounter issues with conflicts of interest as, unlike in other food and fibre industries where supply can be adjusted in accordance with demand and price, kangaroo management will always have a requirement for harvest quotas to be set independently of demand to ensure long-term sustainability. However, this suggestion does draw attention to a point that has been neglected all too long in kangaroo management – that economic and social factors need to be incorporated into harvest management regimes and the aims and policies related to these factors need to be explicitly stated.

As is made clear in the Addis Ababa Principles and Guidelines (Secretariat of the Convention on Biological Diversity 2004), which were developed for use by precisely the sorts of agencies that are involved in managing kangaroo harvesting in Australia, creating the right conditions for the sustainable use of wildlife is about more than just having good scientific data, strong regulatory controls and clearly defined rights of access. It is also about ensuring that the benefits of use are received by those who are in positions of stewardship over the resource and the ecosystems that support it. All kangaroo management programs do not currently, but should, recognise the following key concepts of the Addis Ababa Principles (Secretariat of the Convention on Biological Diversity 2004):

"Sustainable use is a valuable tool to promote conservation of biological diversity, since in many instances it provides incentives for conservation and restoration because of the social, cultural and economic benefits that people derive from that use." (p5) and

[Managers of sustainable use activities should]: "Require adaptive management plans to incorporate systems to generate sustainable revenue, where the benefits go to indigenous and local communities and local stakeholders to support successful implementation" (p12) and

"Promote economic incentives that will guarantee additional benefits to indigenous and local communities and stakeholders who are involved in the management of any biodiversity components" (p19)

Current State plans do not clearly state the economic and social outcomes they aim to deliver through the sustainable use of kangaroos, but in practice their licensing and quota-setting regimes impact on a wide array of economic and social factors. The ways in which licences and harvest tags are issued affects who can carry out the harvest, where it occurs, when it occurs and how the economic benefits of the harvest are distributed. The historical development of the kangaroo industry has created a licensing regime in which kangaroo processors have the greatest amount of flexibility in generating economic returns and landholders have the least.

Processors carry significant risk, as they have to make substantial investments such as plant and staff and are subject to fluctuations in market demand for kangaroo products as well as fluctuations in supply due to climatic patterns, but they also have the flexibility to manage this risk by changing the prices they pay to shooters as well as shifting their supplier base to other locations. Kangaroo shooters have less flexibility than processors to respond to these fluctuations, but they at least have the ability to refocus their efforts on other areas where the economics of shooting may be more viable. Landholders do not have the flexibility to shift their location and thus are most affected by fluctuations in kangaroo populations and distribution. This uncertainty, combined with poor bargaining power when acting alone, makes it difficult for landholders to negotiate a return from shooters or processors for kangaroos harvested on their properties.

Instead of working to counter these difficulties for landholders, State management programs often create additional barriers which make it hard for landholders to plan ahead or group together to increase their bargaining power and manage kangaroos that move across property boundaries. Licensing regimes vary from State to State, but restrictions such as limiting the period for which harvest tags are valid, making tags non-refundable, limiting the number of shooters that can operate on a property and making tags non-transferable across properties can create barriers to industry entry. Hacker *et al.* (2004, p54), in their review of kangaroo management in the Murray-Darling basin, also identified a lack of knowledge regarding the "economic conditions required to induce pastoralists to incorporate kangaroos into their enterprise mix".

We argue that sustainable use of the harvested kangaroo species, in the full sense of the term, should be the overarching aim of all kangaroo management programs and that the social, economic and ecological sustainability of the resource use should all be taken into account, as per the Addis Ababa Principles and Guidelines. In this light, kangaroo management plans should remove obstacles to landholder involvement and actively explore, through an adaptive management framework, management models that can enable landholders to gain greater flexibility in managing the harvest on their properties, collaborate with their neighbours and begin to incorporate kangaroos into their enterprise mix.

Models for landholder involvement

There are a number of ways in which landholders could attempt to derive a return from kangaroos harvested on their properties. Perhaps the simplest way is for them to undertake the harvesting themselves and sell the product to established processors. A number of landholders already do this and they have the advantages of knowing their territory well and being able to incorporate land-management goals into their activities, even if these represent a cost (e.g. shooting feral animals at the same time or targeting harvesting on areas most in need of grazing reductions rather than areas that are simply easiest).

One major downside to this approach is that landholders generally work long hours during the day on their pastoral enterprises and are likely to be reluctant to undertake night-time kangaroo shooting in addition to this, especially given the increasing average age of landholders and decrease in paid labour on properties. A single property is generally incapable of supplying an acceptable income through kangaroo-shooting alone, meaning that giving up domestic stock in favour of kangaroos will be uneconomical unless there is a large rise in price. The massive fluctuations in kangaroo numbers on a single property over time also create a level of uncertainty that makes such a venture very risky.

A second option is to request some kind of royalty that must be paid when shooting is undertaken. This could be negotiated with a shooter or processor individually in return for access to the landholder's territory or as part of a blanket royalty scheme imposed at State level. Limited payments to some landholders for the harvest of kangaroos on their properties has taken place in South Australia, where it has emerged as a result of competition between processors for kangaroo supply. These payments, generally $1 per kangaroo, are not covered by the South Australian Kangaroo Management Plan and are a matter of negotiation between landholders, harvesters and processors (Farroway 2005 pers comm).

Generally, competition for kangaroo supply has not been sufficient for landholders to extract such a royalty, as shooters and processors could simply go to another landholder who is not requesting any return and the landholder who misses out could lose their only real means of managing kangaroo grazing pressure. A blanket royalty scheme would be likely to be met with major opposition from existing processors and harvesters and may prove difficult to administer. Presumably, landholders would still have the right to forgo their royalty payment if they chose, and many may in fact do this if they felt uncomfortable about taking money out of a shooter's pocket or found that shooters would no longer service their property because it had become uneconomic. Such problems could thus undermine any royalty scheme, but, if any of the State management programs wanted to truly say they were implementing the Addis Ababa Principles and Guidelines relating to generating sustainable revenue and guaranteeing additional benefits to local stakeholders the they would at least have to assess this option.

The third option is for landholders to carve out a role for themselves that adds value to the industry and for which they can expect some remuneration other than from undertaking the harvest themselves or from simply providing access. Landholders could add to the industry by enabling harvesting to become more efficient (e.g. predicting where kangaroos will be and when), by enabling larger harvests (e.g. monitoring populations and maintaining greater breeding potential), ensuring continuity of supply (e.g. working closely with harvesters and processors to supply the right quantities at the right time) or by facilitating marketing opportunities based on land management and wildlife stewardship credentials (e.g. certification as sustainable or organic land managers). These options would generally require a significant degree of collaboration across properties due to the fact that kangaroos are a common pool resource that moves freely across property boundaries.

Despite the lack of focus by government agencies, the kangaroo industry and the pastoral industry in exploring these options, a number of models for collaborative landholder participation in the kangaroo industry have emerged in recent years. The Tilpa Rangelands Investment Company (TRIC) in western NSW entered into a collaborative kangaroo harvesting venture from 1995-1998 (Henry and Watson 1998). TRIC investigated ways for its member landholders to gain returns from kangaroo harvesting with the aim of providing incentives for better total grazing management. TRIC's kangaroo enterprise, which focussed largely on skins, ultimately failed to secure a stable place in the kangaroo value chain for landholders. This was largely due to:

- the difficulties of establishing a viable value-adding operation on the skin side of the industry without large volumes and established networks; and
- the difficulties of gaining a return for landholders from the low margins on the meat side of the industry.

However, TRIC's action research identified a number of key factors for gaining industry entry, particularly the importance of landholders undertaking a role that adds value to the existing industry, rather than just expecting to be allowed or legislated in. Many factors affecting the feasibility of kangaroo enterprises have changed since the TRIC experience; such as kangaroo population densities, carcass prices, export and domestic markets and identities of industry players. Stayner (2004, 2005) has considered the TRIC experience amongst many other factors in his analysis of the economics of collaborative kangaroo enterprises, providing a knowledge base for further adaptive management projects to build on.

One such project is the establishment of Wildlife Management Conservancies (WMCs) (Wilson and Mitchell 2005) under the Rangelands and Wildlife Subprogram of the Rural Industries Research and Development Corporation (RIRDC). The WMC model consists of neighbouring landholders who “come together voluntarily to pool resources, plan collaboratively and benefit both economically and socially while also enhancing the sustainability of their properties and the region” (p8). WMCs investigating kangaroo enterprises have been established in southwest Queensland (Maranoa WMC) and along the NSW/Victorian border near Mildura (Barkindji WMC).

The FATE program is also working on models for communal landholder management of kangaroo resources and has also obtained funding through RIRDC’s Rangelands and Wildlife Subprogram. The FATE approach is based on a common property resource system whereby neighbouring properties can explore managing a kangaroo enterprise as a single unit, with the benefits distributed on the basis of the proportion of resources each property contributes to the overall enterprise (Williamson *et al.* 2003).

FATE has embarked on a project involving a group of 27 large pastoral properties that form the Barrier Area Rangecare Group (BARG) in north-western New South Wales (NSW), covering over 1 million hectares in total. These properties, which run sheep and cattle (and also depend on a significant amount of off-farm income) have been collaborating for some time on NRM activities such as feral animal control, weed control and sustainable grazing management. The partnership between BARG and the FATE Program aims to expand this collaboration by managing free-ranging kangaroos as a common property resource, with associated monitoring and management of total grazing pressure across the BARG properties.

BARG and FATE have embarked on an adaptive management trial that seeks to explore ways in which kangaroo enterprises could contribute to both conservation outcomes and economic viability of pastoral properties. Adaptive management is a key principle of managing sustainable use activities (Secretariat of the Convention on Biological Diversity 2004) and involves a cyclic process of continuous improvement with landholders and researchers developing new strategies, putting them into practice and monitoring their impact. The NSW Kangaroo Management Program contains special provisions for approving adaptive management trials and FATE and BARG are negotiating for a greater degree of flexibility in harvesting across property boundaries that will allow BARG to pool harvest tags, undertake harvesting strategically in accordance with total grazing pressure priorities and use their collective bargaining power to enter into more secure financial arrangements with kangaroo harvesters and processors.

Monitoring needs to be a key component of any adaptive management approach to kangaroo management and this trial will monitor kangaroo harvest patterns as well as rangeland health across the trial site using Landscape Function Analysis (LFA) (Tongway and Hindley 2004). Management-induced changes in rangeland health can be very difficult to measure due to high climatic variability and long-term alterations to rangeland health due to grazing (Eldridge and Koen 2003). Collaborative action amongst landholders may provide significant advantages for monitoring through comparisons between neighbouring properties of different ecosystems, stock management strategies and kangaroo harvest strategies and integration with existing data sources such as the Rangeland Assessment Program (RAP), which has operated in NSW since 1989.

Conclusions

While demonstrably sustainable, the current kangaroo industry does not yet fit the model of conservation through sustainable use (CSU) and in order for this to happen, greater landholder involvement in the industry is essential. Landholder involvement could drive significant innovation in management of both the kangaroo harvest and kangaroo habitat, resulting in strategies that improve landscape function and biodiversity. Landholder involvement could also improve the supply chain, enhance product quality and reliability and provide marketing opportunities relating to environmental outcomes.

The conservation outcomes that could result from a successful kangaroo CSU strategy are consistent with regional NRM targets such as:

- increasing the area of conservation on private land (by providing an alternative source of income from such land);
- increasing the area of native vegetation (by creating incentives for vegetation mosaics that suit kangaroos); and
- increasing the extent of ground cover in rangelands (through improved control of total grazing pressure).

If it can be demonstrated that CSU is possible via kangaroo harvest, the industry will be able to unambiguously utilise its environmental credentials in marketing and public relations. This could create a self-reinforcing effect, whereby an increased value of kangaroo products leads to greater landholder returns, greater landholder involvement, conservation outcomes, marketing opportunities through environmental credentials and even greater value for kangaroo products.

For these outcomes to result, kangaroo products need a significant jump in value to get the ball rolling, landholders need mechanisms to get involved in the industry and accurate data is required on the costs of kangaroo production and potential synergies with sheep grazing. At the same time, management of the kangaroo harvest must continue to ensure that the sustainability of kangaroo populations is protected from unregulated market forces and that perverse incentives are not created that drive negative conservation outcomes.

Steps towards the goal of creating a successful CSU model for kangaroo harvesting have been underway for many years and are building in momentum. However, we believe a change in focus is needed from State kangaroo management plans (KMPs) to reflect the principles of sustainable use endorsed in documents such as the Addis Ababa Principles and Guidelines for Sustainable Use (Secretariat of the Convention on Biological Diversity 2004), which have been developed in the time since the current KMPs were approved. As KMPs come up for review, a broader consideration is needed of the economic and social factors that affect kangaroo harvesting activities and ways that these can be linked with broader conservation goals.

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